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Rarely encountered Diptera families in southern Africa: an introductory conservation perspective

by

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ABSTRACT

Invertebrates are often not considered when reviewing conservation and biodiversity issues in southern Africa. This paper reviews the conservation status of 11 rarely encountered Diptera families in the subregion, and presents data on their distribution, biology and habitat requirements (if known) and all other pertinent, published information. As six of the families (Marginidae, Aulacigastridae, Campichoetidae, Neurochaetidae, Tachiniscidae and Corethrellidae) occur in Afromontane forest or its margins, atmospheric warming is briefly discussed, as this could impact on biodiversity at higher altitudes. The conservation of Afromontane forest patches (and associated grassland) in southern Africa is discussed, most notably those in the southeastern highlands of Zimbabwe (source of all known southern African Marginidae, Neurochaetidae, Tachiniscidae) and the central Natal Drakensberg (source of the only named southern African Thaumaleidae, Aulacigastridae, Campichoetidae).

The 11 rarely encountered families are provisionally divided into three groups based on habitat specificity and geographical range. The first group of families is comprised of eurytopic species with widespread geographical ranges (Odiniidae, Ctenostylidae). We predict that informed collecting will show that neither family is particularly uncommon in southern Africa. The second group (Tanyderidae, Thaumaleidae, Marginidae, Aulacigastridae, Neminidae, Campichoetidae, Neurochaetidae) are stenotopic species with restricted geographical ranges. Tanyderidae and Thaumaleidae are considered to be families requiring conservation priority. The third group of families (Tachiniscidae and possibly Corethrellidae) are thought to have species with widespread geographical ranges, but are stenotopic.

INTRODUCTION

One of the most significant threats to biodiversity is the alteration of habitats, usually from highly diverse natural ecosystems to less diverse, often monoculture, agroecosystems. This process often occurs too rapidly for species to adapt to the new conditions, and the consequence is often a great reduction in the area of natural vegetation, leading to the fragmentation of species habitats. Such reductions in area inevitably mean reductions in species populations, resulting in the loss of genetic diversity and subsequently an increase in the vulnerability of species and populations to disease, over-collecting and random population changes (Soulé & Wilcox 1980).

Another important threat to biodiversity is that of global climatic change. Air pollution, together with activities such as deforestation and the burning of fossil fuels, are causing global warming by contributing to an increase in atmospheric levels of carbon dioxide and other greenhouse gases. Schneider (1989) predicted a rise in the average global temperature of 2–6 °C by the end of the next century. However, the exact rate of future warming is speculative due to the complexity of the global climatic system. The discontinuous nature of environments such as mountains, lakes and rivers presents a potential problem in the light of impending global warming. Mountain vegetation is arranged in altitudinal biotic zones, with each zone adapted to the ambient temperature. Such montane areas are of particular importance in southern African dipterology as six of the subregion's rarely encountered Diptera families are restricted to such areas or virtually so. As the climate warms, these life zones will be displaced upwards. Eventually, life zones closest to the peak may be eliminated unless their component species are able to adapt to rapidly changing conditions on an evolutionary time scale (McAllister & Dalton 1992).

There is no quick and easy method for determining how the biological resources of an area may best be conserved, or how land should be used to optimise scope for conservation. Such decisions must take into account ecological, social, political, economic and technological factors. These factors often change over time, and their interrelatedness further complicates matters. Ultimately, decisions need to be made by people exercising their best judgement based on the current state of knowledge. Effective action must be based on accurate information. Today's knowledge of species is sadly inadequate and detailed information on the distribution and population sizes of many species is lacking (McNeely *et al.* 1990). This is particularly the case with invertebrate taxa.

Stuckenberg (1962) pointed out that many invertebrate groups are poorly known and are inadequately represented in collections. While further collecting and taxonomic work will undoubtedly lead to a better understanding of the distribution of such species, more ecological investigations are necessary to elucidate those factors controlling their dispersal. Insect collections contain a vast wealth of information relating to the distribution, habitat requirements and biology of species, which could be used for ecological research. Taxonomists and field collectors are, themselves, a largely untapped source of distributional, ecological, biological and behavioural data.

In this paper we review the distribution, habitat requirements and known biology, conservation status and all known information about 11 rarely encountered families of Diptera in southern Africa. This valuable information should then be made accessible to conservationists and conservation agencies, in the hope that at least some are considered when making decisions about geographical areas that need to be conserved or protected by legislation. This is because invertebrates are relatively poorly known in a taxonomic sense and their small size makes conservation assessment difficult. It is hoped that this work will engender interest in some of the most poorly known families of Diptera in southern Africa, and ensure that they are adequately conserved.

There is a measure of subjectivity in discussing or reviewing rarities in museum collections, as there is usually some form of collecting bias. It should be emphasised that the data discussed below will almost certainly not concur with the actual distributions of some of the families. Further collecting in selected areas needs to be undertaken and it is hoped that this paper will encourage this.

MATERIALS AND METHODS

Southern African Diptera families were considered rare if they were represented by 10 or fewer specimens in the Natal Museum's collection (Tanyderidae excepted), if they were uncommon in other parts of Africa and/or if they were associated with habitats particularly vulnerable to environmental degradation. According to this definition, Braulidae, Carnidae and Chaoboridae may also be termed rare, although they are not treated here. The immature stages of Braulidae live in honey bee wax combs and the adults attach themselves to adult honey bees. Such a specialised lifestyle requires very particular collecting efforts and explains their scarcity in collections. Braulidae seem to occur wherever people use the honey bee (J. F. McAlpine 1989). The Chaoboridae are not uncommon in the Natal Museum's collection, but most are scattered among drawers of undetermined specimens. Carnidae have only been discovered in southern Africa very recently (Barraclough 1994*b*). As with Camilidae, which are similarly coprophagous, specialised collecting techniques are likely to show that the Carnidae are widespread.

Locality data were gathered mainly from the specimen labels in the Natal Museum, as well as from various publications in which the species were described, reviewed or referred to (literature records). All specimens are adult unless otherwise indicated, and depositories are given where possible in the sections on material examined and literature records; data not given on specimen labels (such as co-ordinates) are presented in square parentheses. Co-ordinates have been given where possible. Eurytopic taxa are defined as having generalised habitat requirements, and stenotopic taxa relatively specialised habitat requirements.

Depositories of specimens referred to in the text, and their acronyms (see Arnett *et al.* 1986), are as follows:

AMSA — Australian Museum, Sydney, Australia
BMNH — The Natural History Museum, London, England
CNCI — Canadian National Collection of Insects, Ottawa, Canada
MZLU — Museum of Zoology, Lund University, Sweden
NMBZ — Natural History Museum, Bulawayo, Zimbabwe
NMSA — Natal Museum, Pietermaritzburg, South Africa
SAMC — South African Museum, Cape Town, South Africa
SANC — National Collection of Insects, Pretoria, South Africa
USNM — United States National Museum, Washington, U.S.A.

For the purposes of this paper, southern Africa is defined as Africa south of the Kunene and Zambezi Rivers.

Areas of Afromontane vegetation shown in Fig. 1, were derived from the Unesco, AETFAT & UNSO (1981) vegetation map of Africa. The Afromontane Region shows a disjointed distribution comparable to an archipelago within several regional mountain ranges (White 1978). Tropical Afromontane communities tend to occur between 1500 and 2500 m. Further south, they may occur below 1200 m, as latitude compensates for altitude. In the Cape Region of South Africa, Afromontane forest is found in areas only a few hundred metres above sea level (White 1983).

In his descriptive memoir to accompany the Unesco/AETFAT/UNSO vegetation map of Africa, White (1983) distinguished several vegetation types within the Afromontane-Afroalpine archipelago-like communities. Mixed Afroalpine communities do not occur in southern Africa and have been excluded from Fig. 1 by virtue of the mapping unit code used by Unesco *et al.* (1981). It should be noted that Afromontane areas in Fig. 1 include Afromontane forest, Afromontane bamboo, Afromontane and Afroalpine shrubland, and Afromontane and Afroalpine grassland.

These communities fall under the same mapping unit code and therefore cannot be differentiated.

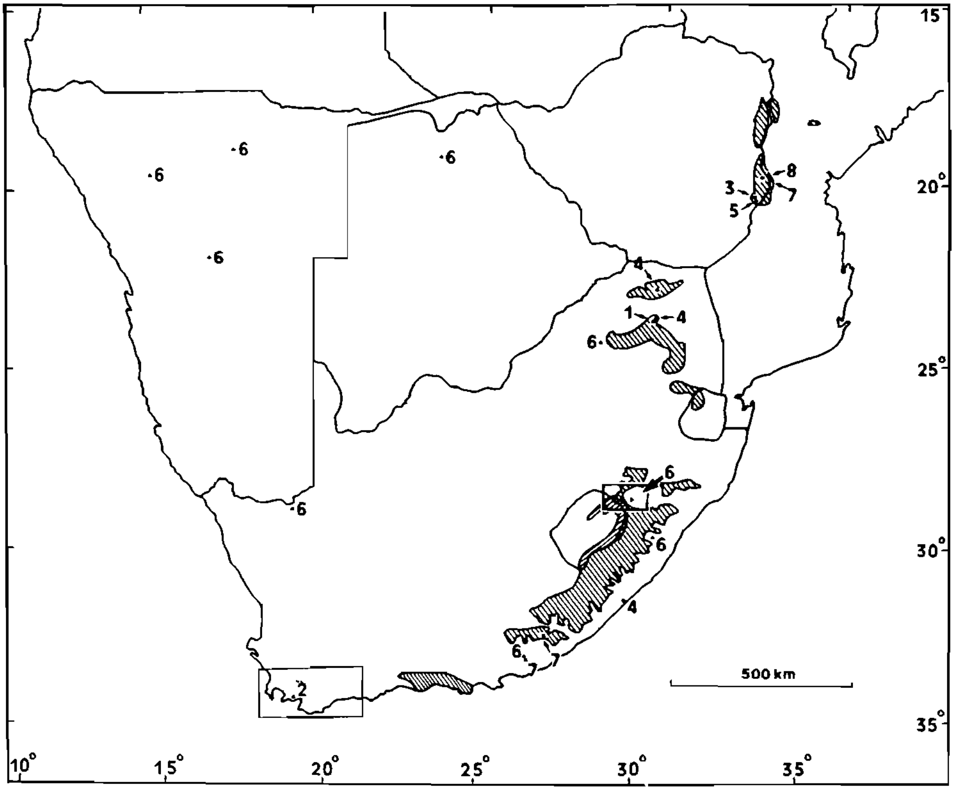

Fig. 1. Known distribution of eight Diptera families in southern Africa: (1) Corethrellidae: *Corethrella harrisoni* Freeman, 1962, (2) Thaumaleidae: *Afrothaumalea* sp. (locality of *A. pamelae* Stuckenberg, 1960 in Fig. 4), (3) Tachiniscidae: *Tachiniscidia africana* Malloch, 1931, (4) Ctenostylidae: *Ramuliseta lindneri* Keiser, 1952, (5) Marginidae: *Margo aperta* D. K. McAlpine, 1991, (6) Odiniidae: *Odinia penrithorum* Cogan, 1975 (more northerly locality) and *Afrodinia* sp. (Namibia), *Traginops moremii* Cogan, 1975 (Botswana), *Afrodinia* spp. (South Africa), (7) Neminidae: *Ningulus simatus* D. K. McAlpine, 1983 (South Africa) and *Ningulus* sp. (Zimbabwe), (8) Neurochaetidae: *Neurocytta prisca* (D. K. McAlpine, 1978). [Shaded area represents Afromontane–Afroalpine communities, with differentiated shading along Lesotho border being mapping unit 66, 'altimontane' (Unesco *et al.* 1981)]. Boxes correspond to southwestern Cape (Fig. 2) and central Natal Drakensberg (Fig. 4).

FAMILY ACCOUNTS

Tanyderidae

Figs 2 & 3

Discussion: This family is known only from a single species in the Afrotropical Region, namely *Peringueyomyina barnardi* Alexander, 1921. *Peringueyomyina* is a monotypic genus. The species is restricted to a relatively small region of the southwestern Cape (South Africa), between Swellendam in the east, Landdroskloof in the west, Franschhoek in the north and Hermanus in the south (Fig. 2). It seems to be associated with streamlets on the southerly slopes of the Dutoitsberg, Riviersonderendberg and Langeberg ranges, with an additional locality at Palmietrivier (these all in the fynbos biome). It is thought to be absent from the northerly half of the Langeberg (as shown in Fig. 2), as this area is situated in the Worcester-Robertson succulent karoo biome (Hilton-Taylor & Le Roux 1989), which is much more arid. Although *barnardi* has been collected from at least six different localities in this region, it has only been collected once since the 1930s (see Material examined, below).

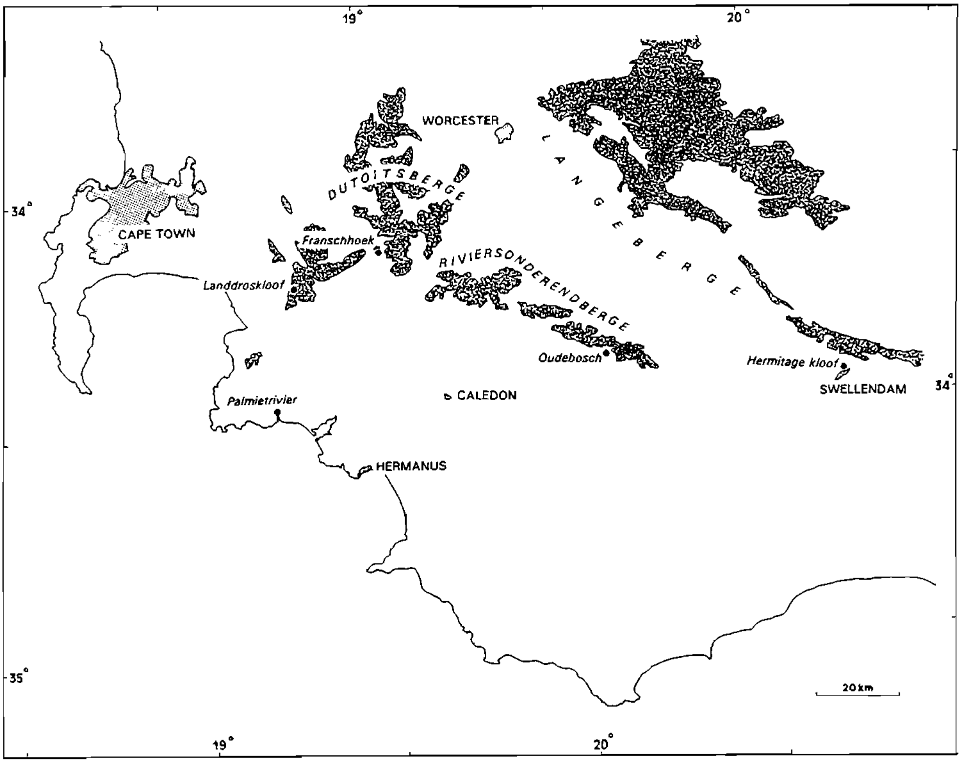

Fig. 2. Known distribution of *Peringueyomyina barnardi* Alexander, 1921 (Tanyderidae) in southwestern Cape Province, South Africa. [Densely shaded areas represent montane regions (> 900 m)].

We contacted Mrs M. Cochrane (Collections Manager, Entomology Department, SAMC), regarding their holdings of Tanyderidae, and established that the type series (holotype and one paratype) is deposited there. In his revision of the Tipulidae of the southwestern Cape, Wood (1952) refers to material of *P. barnardi* from Oudebosch, Landdrost Kloof [sic], French Hoek Pass [sic], Palmiet River [sic] and Hermitage Kloof. The depository of this material is unknown, although it may be present in the unsorted alcohol collections of the South African Museum.

According to Wood (1952), larvae of *barnardi* are aquatic or nearly so, and were found beneath large overhanging boulders in white gravelly sand-spits along the edges of a forest streamlet. Stuckenberg (1962) stated that *P. barnardi* occurs near montane streams. Larvae migrate to drier areas of such sandy stream margins to pupate. Adults were collected from the branches of trees and shrubs in a cool, damp, dark and scoured-out area adjacent to a comparable stream by Dr B. Stuckenberg and Dr J. Londt in early April 1979. Tanyderidae are also associated with smaller gravelly streams in other parts of the world (Exner & Craig 1976).

P. barnardi has been collected only between January and April. This period covers the drier summer and autumn months in the southwestern Cape (a winter rainfall region). As larvae appear to develop in or near the sandy margins of streams, this habitat would presumably be unavailable during the winter rainfall period when stream levels would be much higher and sand-spits probably disturbed by faster flowing currents.

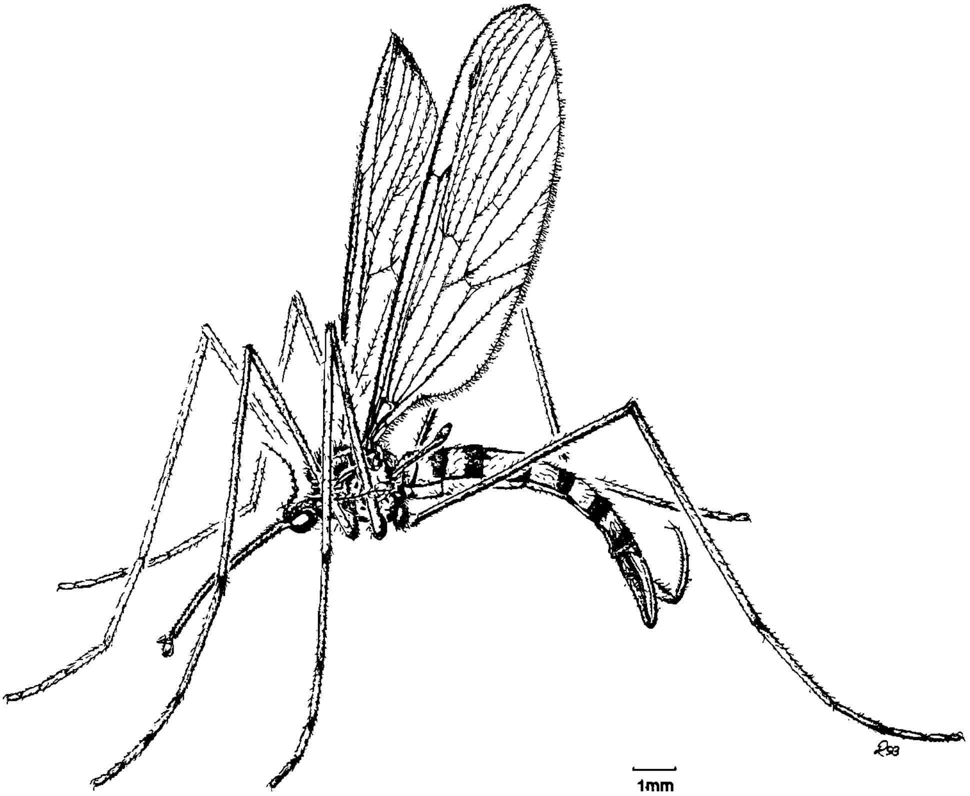

Fig. 3. *Peringueyomyina barnardi* Alexander, 1921 (Tanyderidae), habitus of adult male.

A point of interest in *P. barnardi* is the long proboscis (Fig. 3), which suggests that it feeds on the nectar of tubular flowers common in the fynbos, especially in plant communities rich in *Erica* species, as do some genera of Tipulidae, such as *Geronomyia* Coutin & Harris and *Toxorhina* Loew (Alexander 1921).

The Tanyderidae is a cosmopolitan family which includes about 40 Recent species in 10 genera; the Australasian fauna is the richest with 18 species in 4 genera (Hutson 1980). Tanyderidae are considered to be the most primitive of the nematocerous Diptera (Exner & Craig 1976), and possibly of all living Diptera.

Literature records (*Peringueyomyina barnardi*): SOUTH AFRICA: *Cape*: Holotype ♂, Oudebosch [34°05'S:19°50'E], Caledon, i.1919, K. H. Barnard, 1500 ft (SAMC); Paratype ♂, Hottentots-Holland Mountains, iii.1919, K. H. Barnard, 3000 ft (SAMC) (Alexander 1921). Unstated number, French Hoek Pass [= Franschhoek Pass [33°56'S:19°09'E]], iv.1935, G. A. Wood & H. G. Wood; unstated number (larvae), Hermitage Kloof [34°01'S:20°26'E], i.1938, G. A. Wood & H. G. Wood; unstated number, Landdrost Kloof [= Landdroskloof], i.1933, K. H. Barnard, C. W. Thorne & H. G. Wood; 50 specimens, Oudebosch, i.1932; 3 pupae, 2 pupal exuviae, Oudebosch, i.1933; unstated number, Oudebosch, i.1934, K. H. Barnard, C. W. Thorne & H. G. Wood; unstated number, Palmiet Rivi[e]r, iii.1932, G. A. Wood & H. G. Wood (all referred to in Wood 1952).

Material examined (*Peringueyomyina barnardi*): SOUTH AFRICA: *Cape*: 5 ♂ 7 ♀, Franschhoek, 3319CC, Jan Joubertsgat Riv. [= Joubertsgatbrug] [33°54'S:19°10'E], [*ca.* 3.iv.1979], J. Londt & B. Stuckenberg, open veg. & riverbanks (NMSA).

Corethrellidae

Fig. 1

Discussion: This group has recently been given family status by Wood & Borkent (1989). *Corethrella* Coquillett, 1902 was previously included as a subfamily of Chaoboridae (Hutson 1980). *C. harrisoni* Freeman, 1962 is the only known southern African species of the genus. There are two other species of *Corethrella* in the Afrotropical Region, namely *C. pallitarsis* Edwards, 1930 (Nigeria, Benin) and *C. picticollis* Edwards, 1930 (Nigeria, Uganda) (Hutson 1980). Immature stages are aquatic (Hutson 1980) and have been observed to be predaceous in other Regions (Ellis & Wood 1974).

Corethrellidae appear to be the only Afrotropical family of Diptera not represented in the Natal Museum's collection. Little can be said about the southern African species. Magoebaskloof, the type locality, is part of the Grootbosch Nature Reserve, which is the largest indigenous forest in the Transvaal (Duggan 1990) and is considered to be Afromontane forest (Fig. 1). However, it is possible that the species is associated with stream banks both in and out of the forest.

Literature record (*Corethrella harrisoni*): SOUTH AFRICA: *Transvaal*: Holotype ♂, 5 ♂ Paratypes, Magoebas Kloof [= Magoebaskloof 23°51'S:30°02'E], 6.v.1955, A. D. Harrison (BMNH) (Freeman 1962).

Thaumaleidae*

Figs 1 & 4

Discussion: Thaumaleidae are represented in southern Africa by one named species and one unnamed species. Both are from temperate climates and belong to the endemic genus *Afrothaumalea* Stuckenberg, 1960. *Afrothaumalea* seems to be a palaeogenic, austral element and may have affinities with the Australasian genus *Austrothaumalea* Tonnoir, 1927. Both southern African species are montane; this habit is also reported for extralimital species (Vaillant 1960). The named species, *A. pamelae* Stuckenberg, 1960 was swept from damp herbage overhanging a rock face wetted by seepage, on steep terrain at the foot of the Organ Pipes Pass in the Cathedral Peak area (Natal, South Africa). Vegetation at this altitude is Afroalpine shrubland, ie. mainly grassland with ericaceous shrubs (Stuckenberg 1960). Larvae are not known from southern Africa, but in the literature are reported submerged in thin films of water flowing over rocks in cool mountain streams (Stuckenberg 1980). Adults are infrequent fliers and inhabit damp sites near larval habitats (Stuckenberg 1980). *A. pamelae* has not been collected since its description, despite a search by Dr B. Stuckenberg.

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* Refer also to Addendum at end of paper.

The second specimen of *Afrothaumalea* belongs to an undescribed species from the southwestern Cape (see below), east of Hermanus (Fig. 2) in the Kleinriviersberg range. It was collected from a moist, shaded habitat at the base of a deep ravine.

Thaumaleidae contains about 122 described species in 9 genera (McLellan 1988; Peterson & Theischinger 1989). They are mainly Holarctic in distribution, with 3 genera and about 30 species from the southern hemisphere. Theischinger (1986) suggests a Gondwanan origin for the southern hemisphere Thaumaleidae, as the austral fauna have closer links with each other than to the northern hemisphere fauna.

Literature record (*Afrothaumalea* sp.): SOUTH AFRICA: *Cape*: 1 ♂, Maanschynkop [34°23'S:19°20'E], 7 miles E of Hermanus, 1955, Brinck & Rudebeck (MZLU) (Stuckenberg 1961).

Material examined (*Afrothaumalea pamelae*): SOUTH AFRICA: *Natal*: Holotype ♀, foot of Organ Pipes Pass [29°01'S:29°11'E], Cathedral Peak area, iii.1959, P. J. Stuckenberg, 9300 ft (NMSA).

Tachiniscidae

Figs 1 & 5

Discussion: In southern Africa, Tachiniscidae are known only from the male holotype of *Tachiniscidia africana* Malloch, 1931 from Chirinda Forest (see below) (Fig. 5). Chirinda Forest is Afromontane (Fig. 1). Although beyond the geographical scope of this study, the Natal Museum collection also has a single female of *africana* from Malawi (Zomba, 1535Ad, 24–27.xi.1980, Londt & Stuckenberg, 1100 m) which is also Afromontane.

Tachiniscidia appears to be quite widespread, as it also occurs in Nigeria (Cogan 1980*a*). However, it is restricted to Afromontane forest. J. F. McAlpine (1989: 1442) referred to an undescribed species of *Tachiniscidia* from Angola, but the depository of the specimen is not stated. *Bibundia hermanni* Bischof, 1903 (Cameroun, Benin, Central African Republic, Sierra Leone, Uganda) is the only other named Afrotropical species.

Nothing is known about the biology of *Tachiniscidia*, although *Bibundia* has been reared from the caterpillar of a saturniid moth (Roberts 1969). If *Tachiniscidia africana* is a parasitoid, it is possible that its distribution is strongly linked to that of its host.

Literature record (*Tachiniscidia africana*): ZIMBABWE: Holotype ♂, Chirinda Forest [20°26'S:32°42'E], x.1926 (NMBZ) (Malloch 1931).

Ctenostylidae

Fig. 1

Discussion: There are two Afrotropical species of Ctenostylidae, namely *Ramuliseta lindneri* Keiser, 1952 from southern and east Africa, and *R. madagascariensis* Hennig, 1960 from eastern and southern Madagascar. *R. lindneri* is known from three localities in South Africa, but not elsewhere in southern Africa. Adults are nocturnal and are taken at light, particularly mercury vapour traps. This almost certainly accounts for the rarity of this species in collections. It is considered likely that specialised collecting would result in a much larger number of specimens from southern Africa.

Nothing is known about the biology of Ctenostylidae. Until biological information becomes available it is difficult to predict what sort of distribution the family could have in southern Africa, but it is probable that there will not be a close association with Afromontane areas. Only females are known and the species is possibly parthenogenetic (see Barraclough (1994*a*) for further details, particularly concerning morphology).

Material examined (*Ramuliseta lindneri*): SOUTH AFRICA: *Transvaal*: 4 ♀, Fanie Botha Nat. Res., nr. Tzaneen, 23°50'S:30°10'E, 2–6.iii.1986, B. Grobbelaar, light trap (NMSA, SANC); 1 ♀, Zoutpansberge Dist. [= Soutpansberg District], vi.1920, H. C. Breyer (NMSA). *Transkei*: 1 ♀, Port St. Johns Dist. [31°35'S:29°25'E], 20–25.xi.1961, B. & P. Stuckenberg, at mercury vapour light trap (NMSA).

Marginidae

Figs 1 & 5

Discussion: The family Marginidae was described only recently (D. K. McAlpine 1991), and is based on two species: *Margo aperta* McAlpine, 1991 from Zimbabwe and *M. clausa* McAlpine, 1991 from Madagascar. McAlpine suggested that degradation of forest habitats has already restricted the distribution of this group and that Marginidae are among the Diptera families most at risk of extinction. As with Tachiniscidae, the only southern African record is from Chirinda Forest (Afromontane) in Zimbabwe (Figs 1 & 5). *M. aperta* was swept from herbage adjacent to the road in Chirinda Forest Botanical Reserve (Stuckenberg, *pers. comm.*).

Literature record (*Margo aperta*): ZIMBABWE: Paratype ♂, Chirinda Forest, Mt. Selinda, [20°26'S:32°42'E], 25.i.1955, B. R. & P. Stuckenberg, (AMSA) (D. K. McAlpine 1991).

Material examined (*Margo aperta*): ZIMBABWE: Holotype ♂, 1 ♂ Paratype, Chirinda Forest, Mt. Selinda, [20°26'S:32°42'E], 25.i.1955, B. R. & P. Stuckenberg, (NMSA).

Odiniidae

Fig. 1

Discussion: As with Ctenostylidae, Odiniidae are probably only apparent rarities, and selective collecting could well prove that they are not uncommon in particular microhabitats. Eight species in four genera are recorded from the Afrotropical Region (Cogan 1980*b*), and at least three genera and four species from southern Africa (*Afrodinia deemingi* Cogan, 1975; *Afrodinia* sp.; *Odinia penrithorum* Cogan, 1975; *Traginops moremii* Cogan, 1975). The scattered positions of the nine known southern African localities suggest that the family is widespread in the subregion; most of the localities are in arid or semi-arid areas.

In other parts of the world, Odiniidae have specialised life histories and are reported to be associated with the larvae of stem-boring or gall-forming Coleoptera and Lepidoptera (Cogan 1980*b*). Bearder & Martin (1980) found larvae of an *Afrodinia* species within branch and trunk sections of an *Acacia* tree near Naboomspruit (Transvaal, South Africa). Gum was reported to accumulate inside the internal galleries produced by beetle and moth larvae. It is thought that the gum provided a nutritive medium for the development of odiniid larvae. Adult *Afrodinia* have been reared from these larvae by Dr R. Toms and are deposited in the General Entomology collection (Transvaal Museum); we have unfortunately not been able to examine them.

Literature records: (*Afrodinia* sp.): SOUTH AFRICA: *Transvaal*: unstated number of specimens, Private Nature Reserve Mosdene, 24°35'S:28°47'E, nr. Naboomspruit, viii.1975–viii.1977 (Bearder & Martin 1980). (*Odinia penrithorum*): NAMIBIA: Holotype ♂, Otjitambi Farm, 43.5km ESE Kamanjab, 13–15.ii.1972, Southern African Expedition (BMNH) (Cogan 1975). (*Traginops moremii*): BOTSWANA: Holotype ♂, Moremi Reserve, 19°23'S:23°33'E, 18–20.iv.1972, Southern African Expedition, swept from densely shaded undergrowth in a small thicket (BMNH) (Cogan 1975).

Material examined: (*Afrodinia* sp.): SOUTH AFRICA: *Natal*: 1 ♀, Spioenkop Nature Reserve [28°43'S:29°35'E], 2829CB, 3–6.x.1981, J. & A. Londt (NMSA); 1 ♀, Univ. Natal, Ukulinga Res. Frm, 10 km SE Pietermaritzburg [29°37'S:30°23'E], 31.i–5.ii.1986, R. M. Miller, grassland, impoundment, malaise trap (NMSA). *Cape*: 1 ♀, 3 km NW Grahamstown [33°18'S:26°32'E], Strowan Farm, 3326DB, 1–2.i.1986, J. Londt, *Acacia* grassland (NMSA). (*Afrodinia deemingi*): SOUTH AFRICA: *Cape*: 1 ♀, 10 miles north of Pella [29°02'S:19°09'E], bank of Orange River, 2819CC, 4.ix.1972, M. E. Irwin, sandy bank, 940ft (NMSA). NAMIBIA: 1♀, Okahandja, 2–4.ii.1972, Southern African Exp. B. M. (BMNH); 1 ♂ 2 ♀, Omguma Farm, 55 mls NW Tsumeb, 17–19.ii.1972, Southern African Exp. B.M., at light (BMNH).

Aulacigastridae

Fig. 4

Discussion: Aulacigastridae are here restricted to the subfamily Aulacigastrinae; subfamily Neminae are given family rank in accordance with a forthcoming publication by Dr A. Freidberg. The first species of Aulacigastridae to be described from the Afrotropical Region belong to the genus *Aulacigaster* Macquart, 1835 (Barraclough 1993). There are two southern African species and a single species from Cameroon. Both of the southern African species are known only in the central Natal Drakensberg; one of them is still undescribed. They appear to be restricted to montane refugia, in or adjacent to Afromontane forest.

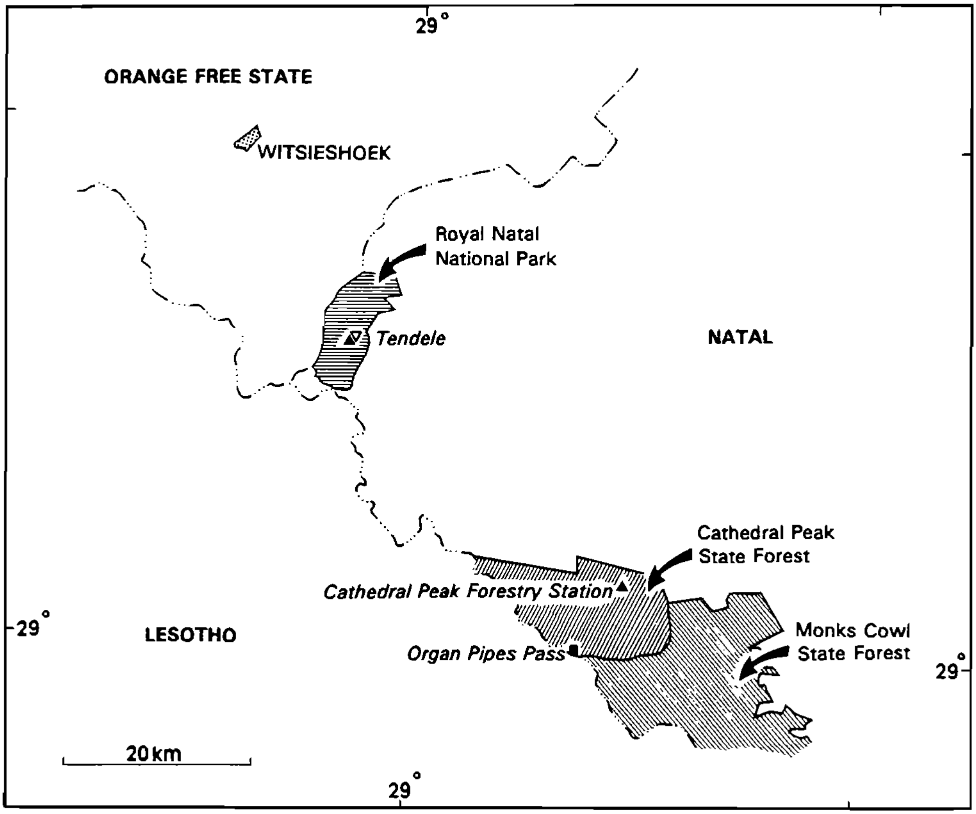

Fig. 4. Known distribution of three Diptera families in central Natal Drakensberg: ▽ = Campichoetidae (*Campichoeta natalensis* Barraclough, 1992), ▲ = Aulacigastridae (*Aulacigaster africana* Barraclough, 1993 (Tendele) and *Aulacigaster* sp. (Cathedral Peak), ■ = Thaumaleidae (*Afrothaumalea pamelae* Stuckenberg, 1960).

Nothing is known about the biology of Afrotropical Aulacigastridae, although immature stages are likely (as with northern hemisphere species) to develop in the sap flows of trees, where pupation takes place (Barraclough 1993). The rarity of adults in collections could be linked to the fact that they are most active in early spring, when collecting activities are uncommon. Also of interest is that the specimens of *A. africana* were taken at 07h30, a time at which very little active insect collecting is done.

Aulacigastridae are considered to be a relict group (Hennig 1965); their discontinuous distribution between Natal and Cameroon tends to confirm this, although further collecting is needed.

Material examined: (*Aulacigaster africana*): SOUTH AFRICA: *Natal*: Holotype ♂, 2 ♀ Paratypes, 1 ♂, Royal Natal Nat. Park, 28°43'S:28°56'E, 2.ix.1992, A. E. Whittington, 1540 m, indigenous forest nr. Tendele and Tugela, rock ledge (NMSA). (*Aulacigaster* sp.): SOUTH AFRICA: *Natal*: 1 ♂, Cathedral Peak Forestry Station [28°57'S:29°12'E], 75 km WSW Estcourt, 7–31.xii.1979, S. & J. Peck, 1500 m (CNCI).

Neminidae

Figs 1 & 5

Discussion: Very little is known about Afrotropical Neminidae, which comprise five species. There are two southern African species; one from the eastern Cape Province of South Africa (*Ningulus simatus* D. K. McAlpine, 1983), and an undescribed *Ningulus* species from the Chimanimani National Park in eastern Zimbabwe (Barraclough 1993) (Figs 1 & 5). Dr A. Freidberg (*in litt.*) has completed a manuscript in which he describes a new genus and three new species from Madagascar. The southern African Neminidae appear to be associated with Afromontane forest over much of their range (Grahamstown locality excepted). Only two specimens are known from South Africa, despite particular collecting efforts.

Literature record: (*Ningulus* sp.): ZIMBABWE: 1 ♂, Banana Grove, Chimanimani Nat. Park [19°47'S:33°01'E], 23.ix.1990, D. K. McAlpine, collected from *Strelitzia augusta* [= *nicolai*] (AMSA) (Barraclough 1993).

Material examined: (*Ningulus simatus*): SOUTH AFRICA: *Cape*: Holotype ♀, Grahamstown [33°18'S:26°32'E], Albany District, 30.ix.1953 (NMSA); Paratype ♂, Hogsback [32°35'S:26°56'E], N of Alice, xi.1964, B. & P. Stuckenberg (NMSA).

Campichoetidae

Fig. 4

Discussion: Barraclough (1992) recently treated Campichoetidae as a subfamily of Diastatidae, but we here give the group family status in accordance with Chandler (1987), Grimaldi (1990) and Colless & McAlpine (1991). Campichoetidae are a boreal group and the African species are the only ones known from the southern hemisphere. Only one species based on one specimen is known from southern Africa (*Campichoeta natalensis* Barraclough, 1992), this taxon being closely related to *C. edwardsi* Barraclough, 1992 from Kenya and Ethiopia. All these specimens were taken in Afromontane areas at or above 1500 m.

It is likely that African *Campichoeta* species have similar habitats to the Holarctic species, which are taken from rich, herbaceous vegetation adjacent to moist woodland or from stream banks (Barraclough 1992). African Campichoetidae appear to have retracted (refugial) distributions resulting from past climatic changes, although the original mechanism of dispersal from the Palaearctic Region remains speculative. *C. natalensis* was not collected at its type locality in September 1992, despite a particular search in suitable habitats.

Material examined: (*Campichoeta natalensis*): SOUTH AFRICA: *Natal*: Holotype ♀, Royal Natal Nat. Park [28°41'S:28°59'E], Drakensberg Mtns, 11.ix.1963, B. & P. Stuckenberg, 1530 m, from montane forest (NMSA).

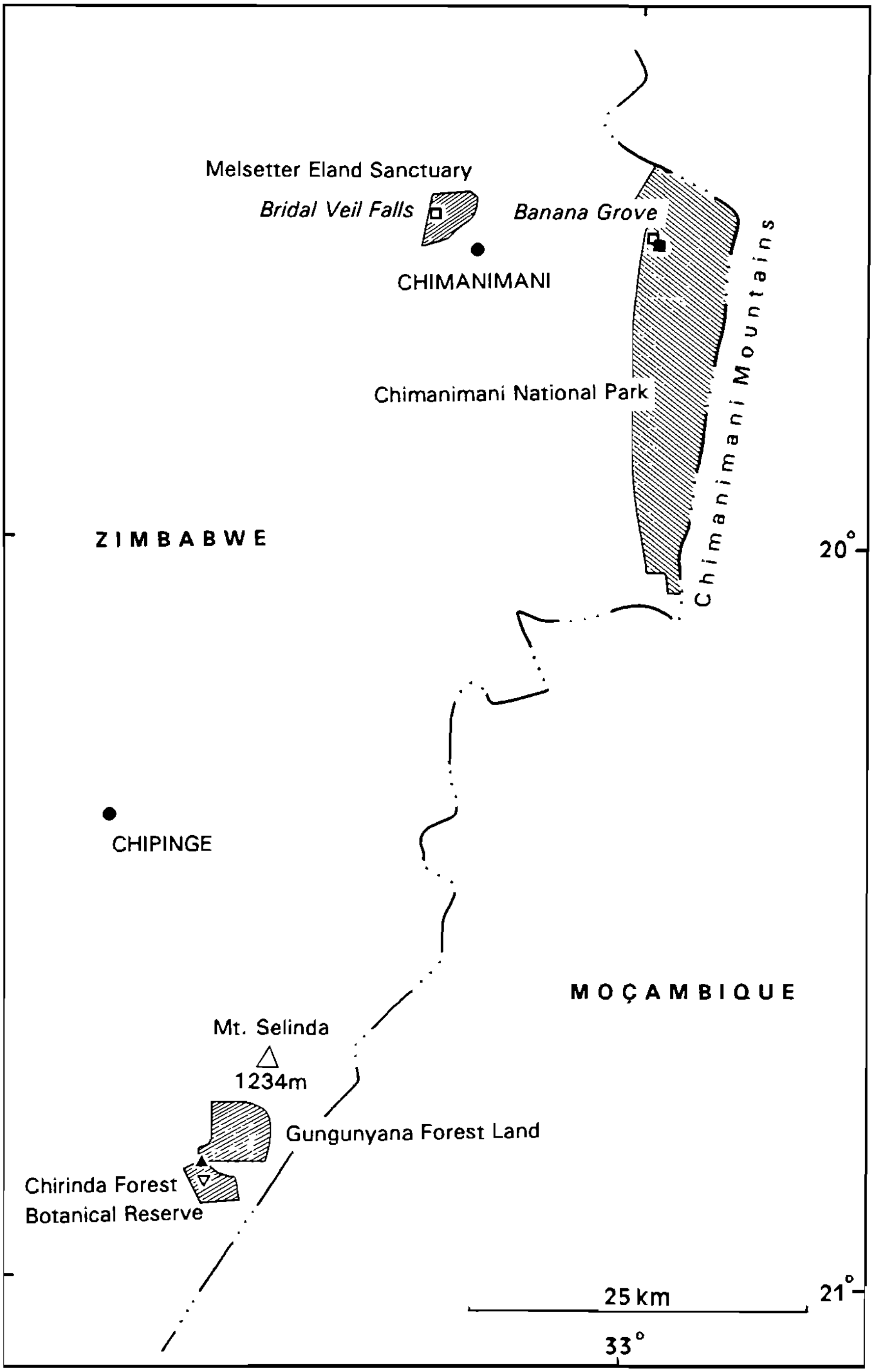

Fig. 5. Known distribution of four Diptera families in the southeastern highlands of Zimbabwe: ▽ = Tachiniscidae (*Tachiniscidia africana* Malloch, 1931), ▲ = Marginidae (*Margo aperta* D. K. McAlpine, 1991), ■ = Neminidae (*Ningulus* sp.), □ = Neurochaetidae (*Neurocytta prisca* D. K. McAlpine, 1978).

Neurochaetidae

Figs 1 & 5

Discussion: Neurochaetidae are an Old World family with only one African species; the Madagascan fauna is substantially richer and 11 species have now been recorded from the island (D. K. McAlpine 1993). The sole African species (*Neurocytta prisca* (D. K. McAlpine, 1978)) is southern African and occurs only in Chimanimani and the nearby Chimanimani National Park (Zimbabwe) (Figs 1 & 5). It is of particular interest in that it is the most primitive genus of Neurochaetidae and has closest affinity with the Baltic amber fossil *Anthoclusia* Hennig (Eocene-Oligocene). Both Zimbabwean localities are in Afromontane forest and it appears that *prisca* (now known from six specimens) has a close association with *Strelitzia nicolai* (L.f.) Skeels (given as *augusta* Thunberg). It is likely that *S. nicolai* is the host plant of *Neurocytta prisca* (D. K. McAlpine 1993). Neurochaetidae have never been found in South Africa, despite intensive collecting in suitable habitats by Dr D. Barraclough.

Note that McAlpine (1993) refers to the Chimanimani *Strelitzia* species as *augusta*. However, Palgrave (1977) records only *nicolai* from the eastern highlands of Zimbabwe, and this identification is accepted in this paper.

Literature record: (*Neurocytta prisca*): ZIMBABWE: 4 ♀, Banana Grove [19°47'S:33°01'E], 22 km E of Chimanimani (formerly Melsetter), Chimanimani Nat. Park, 23.ix.1990, D. K. McAlpine, 1500 m, collected from *Strelitzia augusta* [= *nicolai*] (AMSA, USNM) (McAlpine 1993).

Material examined: (*Neurocytta prisca*): ZIMBABWE: Holotype ♀, Paratype ♂, Melsetter [= Chimanimani], [Bridal Veil Falls, 19°46'S:32°50'E], x.1950, H. K. Munro (NMSA).

DISCUSSION

Ferrar (1989) drew attention to the complex nature of the rarity concept and cautioned against its simplification to a mere ordering of species from extinct to superabundant. He proposed a variation of Rabinowitz's eight-box conceptual model of rarity (Rabinowitz *et al.* 1986), which demonstrates the relationships between three aspects of biological rarity pertaining to a species or population. These aspects are:

1. Habitat specificity (specialisation)
2. Geographic range (distribution)
3. Local population size

Species or populations may then be categorised in terms of level of rarity by assessing the applicability of one or more of the above attributes.

As mentioned above, the 'rare' Diptera families reviewed in this paper were selected on the basis of three subjective criteria. Very little is known about these groups and they are probably poorly collected. Consequently, the true extent of their distribution, relative abundances and habitat specificity often remain open to speculation, making it difficult to assess the rarity of these taxa using the above model. What is certain though, is that all 11 families reviewed are rarities, in the sense that they are always unrepresented in smaller museum collections. Based on present information, none of these families have been routinely collected. One hundred and two families of Diptera are recorded from the southern African subregion to date. As about one family in ten is rarely encountered, it is thus of great concern that the representation and distribution of these Diptera be adequately monitored, so as to avoid the regional extinction of particular families.

Population size excluded, it is easy provisionally to categorise the 11 families into three groups. The first group has eurytopic species with widespread geographical ranges (Odiniidae and Ctenostylidae). The taxonomy of southern African Odiniidae has not been properly elucidated, but it is certain that at least one *Afrodinia* species is widespread in the subregion and is found in different types of *Acacia* grassland. The sole southern African species of Ctenostylidae, *Ramuliseta lindneri* Keiser, 1952, has been collected from coastal forest in the Transkei and variable forest types (including Afromontane) in the northern Transvaal. The apparent rarity of the Ctenostylidae may be attributed to their nocturnal habits, while the specialised association of odiniids with gum exudates may explain their scarcity in collections. If informed collecting procedures are adopted, we do not expect these families to be uncommonly encountered in future.

The second group of families contains stenotopic species with restricted geographical ranges (Tanyderidae, Thaumaleidae, Marginidae, Aulacigastridae, Neminidae, Campichoetidae, Neurochaetidae). The immature stages of Tanyderidae and Thaumaleidae are aquatic or semi-aquatic and the remaining families, with the possible exception of the Neminidae, are strongly associated with Afromontane forest or its margins. The southern African Tanyderidae and Thaumaleidae are almost certainly Gondwanan relicts, and the families do not occur elsewhere in the Afrotropical region. These are both important points and we believe that these two families should be conservation priorities. At least one of the Madagascan species of Neurochaetidae (*Neurotexis charis* D. K. McAlpine, 1993) is widespread on the island, but we believe this is unlikely for the plesiomorphic African species, *Neurocytta prisca* (D. K. McAlpine, 1978). Preliminary evidence suggests that the population sizes of families in the second group are not all necessarily very small. Both the Tanyderidae and Aulacigastridae have been found to be locally numerous on the occasions when collected by Natal Museum staff. The Neurochaetidae may also prove to be abundant on the host plant, *Strelitzia nicolai*, in areas at or near the type locality in the Chimanimani area of eastern Zimbabwe. This could not be properly ascertained, as stated by D. K. McAlpine (1993: 236), because of limited access to the leafy crowns of adult plants and to the plants themselves which occur in rough terrain.

The third group comprises only the Tachiniscidae, which we consider to have stenotopic species with widespread geographical ranges. In southern Africa *Tachiniscidia africana* Malloch, 1931 is known only from Chirinda Forest in eastern Zimbabwe, but is otherwise known from Malawi and Nigeria (see discussion under Tachiniscidae, above), and is obviously widespread in Africa. However, it is probably restricted to Afromontane forest. The Corethrellidae possibly also belong in this group, although very little is known about the family in the Afrotropical Region. In southern Africa the family is known only from an Afromontane area in the the northern Transvaal (South Africa). Much more research into the distribution, ecology and biology of the Corethrellidae and most of the other families discussed above is necessary, before an accurate appraisal of their status will be possible.

At least 6 of the 11 families dealt with in this paper occur only in Afromontane forest belts, and consequently the preservation of these small areas is critical to the survival of the Diptera concerned. Indigenous forests comprise the smallest biome in southern Africa, covering less than 3000 km^2. Today's 'relict' nature of forests within the grassland and fynbos biomes has been ascribed to climatic and landscape changes dating back to the Holocene (Deacon 1983), as well as to destructive human activities during the past 100–300 years (White 1983), and fires brought on by hot, desiccating winds (Geldenhuys & MacDevette 1989). However, according to Meadows & Linder (1993), it is the grasslands, rather than the forests that form the relict communities of the southern Afromontane region. This is based on the suggestion by Hamilton (1982), that much of tropical and subtropical Africa experienced cooler and drier conditions than today, during the last glacial maximum (18000 ± 3000 BP), promoting fire and favouring grassland rather than forest communities.

Mountain ranges, river valleys and adjacent vegetation areas often serve as corridors allowing the dispersal of forest organisms. However, in some areas, the climate of mountains and river valleys, and the nature of landuse practices bordering forests may act as barriers to dispersal (Geldenhuys & MacDevette 1989). MacArthur & Wilson (1967) emphasised that the future survival of sensitive forest biota will be determined by the size of, and distance between, isolated forests. The large ratio of forest margin to forest area, highlights the importance of forest margins in forest survival (Geldenhuys & MacDevette 1989). Forest margins are often the richest in terms of insect diversity, and regularly yield more specimens than the forest interiors. Bearing this in mind, it is important to note that the margins are the first areas of forests to be affected by disturbances such as grazing, clearing for agriculture and the invasion of exotic species.

Each of the rare Diptera families discussed has at least one locality in a nature reserve. Nevertheless, future stategies in forest conservation need to include policies for the protection and management of vegetation adjacent to forest margins (Geldenhuys & MacDevette 1989). In addition, small forest patches need to be recognised for their value as gene pools and dispersal routes for many insect groups, including Diptera. As far as southern Africa and the families discussed above are concerned, forest patches most in need of conservation are in the southeastern highlands of Zimbabwe and the central Natal Drakensberg of South Africa (Figs 1, 4 & 5). These fall within the sixth (Chimanimani) and seventh (Drakensberg) regional mountain systems in the Afromontane archipelago (White 1978). Remarkably, in southern Africa, three families of Diptera are known only from the Chimanimani mountain system. These are the Tachiniscidae, Marginidae and Neurochaetidae (Fig. 5); the last two families are not recorded elsewhere from the African mainland and may be southern elements. While Neurochaetidae occur in the Chimanimani National Park area, Marginidae and Tachiniscidae have been collected only in Chirinda Forest (Fig. 5). White (1978) considers that Chirinda is transitional between Afromontane and lowland forest. Marginidae are thought to be one of the Diptera families most at risk of extinction (D. K. McAlpine 1991), particularly given that the family is restricted to the Afrotropical Region. The East African Mormotomyiidae is the only other named Diptera family endemic to the afrotropics.

The central Natal Drakensberg is the source of three families which do not have named species from any other part of southern Africa (Fig. 4). The families in question are Thaumaleidae (also with an unnamed species from the southwestern Cape near Hermanus (Fig. 1)), Campichoetidae and Aulacigastridae. All have been collected only from areas conserved by the Natal Parks Board (Royal Natal National Park and Cathedral Peak State Forest). Note, however, that only the Aulacigastridae have a definite association with forested areas, although the Campichoetidae are likely to occur near forest margins. All three families are of particular scientific importance. As already stated, Thaumaleidae are thought to be of Gondwanan origin and Aulacigastridae are a relict group. Campichoetidae are one of only three truly boreal families in the southern African fauna, the other two being Diastatidae and Opomyzidae. All are predominantly Holarctic with outlying species in the southern hemisphere.

A recurring theme in this paper is the importance of Afromontane areas, particularly forest and forest margins, as a source of rarely encountered Diptera families in southern Africa. These areas need intensive assessment, at the very least inclusive of other invertebrate groups. Only then can representative and objective data be presented to conservationists. The end result would hopefully be the establishment or reinforcement of adequate protective measures for the southern African invertebrate fauna.

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REFERENCES

Alexander, C. P. 1921. The crane-flies of South Africa in the South African Museum (Diptera, Tipulidae) Part 2. *Annals of the South African Museum* **18**: 181–230.

Arnett, R. H. Jr, Samuelson, G. A., Heppner, J. B., Nishida, G. M., Watt, J. C. & Woodruff, R. F. 1986. *The insect and spider collections of the world.* Gainesville: E. J. Brill/Flora & Fauna Publications.

Barraclough, D. A. 1992. A synopsis of the Afrotropical Diastatidae (Diptera), with the description of five new species from southern and east Africa and first record of the Campichoetinae. *Annals of the Natal Museum* **33** (1): 13–36.

——— 1993. The Afrotropical species of *Aulacigaster* Macquart (Diptera: Aulacigastridae: Aulacigastrinae). *Annals of the Natal Museum* **34** (1): 31–42.

——— 1994*a*. A review of Afrotropical Ctenostylidae (Diptera: Schizophora: ?Tephritoidea), with redescription of *Ramuliseta lindneri* Keiser, 1952. *Annals of the Natal Museum* **35**: 5–14.

——— 1994*b*. *Hemeromyia australis* sp.n. and *Meoneura prima* (Becker, 1903) from Namibia and South Africa, the first Carnidae (Diptera: Schizophora) recorded from subequatorial Africa. *Annals of the Natal Museum* **35**:15–24.

BEARDER, S. K. & MARTIN, R. D. 1980. *Acacia* gum and its use by bushbabies, *Galago senegalensis* (Primates: Lorisidae). *International Journal of Primatology* **1** (2): 103–128.

CHANDLER, P. J. 1987. The families Diastatidae and Campichoetidae (Diptera, Drosophiloidea) with a revision of Palaearctic and Nepalese species of *Diastata* Meigen. *Entomologica Scandinavica* **18**: 1–50.

COGAN, B. H. 1975. New taxa in two families previously unrecorded from the Ethiopian Region (Diptera: Odiniidae and Diastatidae). *Annals of the Natal Museum* **22** (2): 471–488.

——— 1980*a*. Family Tachiniscidae. *In*: Crosskey, R. W. ed. *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History) p. 555.

——— 1980*b*. Family Odiniidae. *In*: Crosskey, R. W. ed. *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History) p. 637.

COLLESS, D. H. & MCALPINE, D. K. 1991. Diptera (Flies). *In*: CSIRO, Division of Entomology, ed. *The insects of Australia: a textbook for students and research workers*. 2nd ed. Vol. 2. Carlton: Melbourne University Press pp. 717–786.

DEACON, H. J. 1983. An introduction to the fynbos region, time scales and paleaoenvironments. *In*: Deacon, H. J., Hendey, Q. B. & Lambrechts, J. J. N. eds. Fynbos palaeoecology: a preliminary synthesis: a report of the Soils and Geomorphology Study Group of the Fynbos Biome Project. *South African National Scientific Programme Report* **75**: 1–20.

DUGGAN, A. ed. 1990. *Illustrated guide to the game parks and nature reserves of southern Africa*. Cape Town: Reader's Digest Association of South Africa.

ELLIS, R. A. & WOOD, D. M. 1974. First Canadian record of *Corethrella brakeleyi* (Diptera: Chaoboridae). *Canadian Entomologist* **106**: 221–222.

EXNER, K. & CRAIG, D. A. 1976. Larvae of Alberta Tanyderidae (Diptera: Nematocera). *Quaestiones Entomologicae* **12**: 219–237.

FERRAR, A. A. 1989. The role of red data books in conserving biodiversity. *In*: Huntley, B. J. ed. *Biotic diversity in southern Africa*. Cape Town: Oxford University Press p. 136–147.

FREEMAN, P. 1962. Notes on Chaoboridae (Diptera: Nematocera), with descriptions of a new genus and of two new species from Australia and Africa. *Proceedings of the Royal Entomological Society of London Ser. B* **31** (3/4): 41–43.

GELDENHUYS, C. J. & MACDEVETTE, D. R. 1989. Conservation status of coastal and montane evergreen forest. *In*: Huntley, B. J. ed. *Biotic diversity in southern Africa*. Cape Town: Oxford University Press p. 224–238.

GRIMALDI, D. A. 1990. A phylogenetic, revised classification of genera in the Drosophilidae (Diptera). *Bulletin of the American Museum of Natural History* **197**: 1–139.

HAMILTON, A. C. 1982. *Environmental history of East Africa*. London: Academic Press.

HENNIG, W. 1965. Die Acalyptratae des Baltischen Bernsteins und ihre Bedeuting für die Erforschung der phylogenetischen Entwicklung dieser Dipteren-Gruppe. *Stuttgarter Beiträge zur Naturkunde* **145**: 1–215.

HILTON-TAYLOR, C. & LE ROUX, A. 1989. Conservation status of the fynbos and karoo biomes. *In*: Huntley, B. J. ed. *Biotic diversity in southern Africa*. Cape Town: Oxford University Press p. 202–223.

HUTSON, A. M. 1980. Family Tanyderidae. *In*: Crosskey, R. W. ed. *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History) p. 92.

MALLOCH, J. R. 1931. Exotic Muscaridae (Diptera) – XXXII. *Annals and Magazine of Natural History* (10) **7**: 314–340.

MCALLISTER, D. E. & DALTON, K. W. 1992. How global warming affects species survival. *Canadian Biodiversity* **2** (2): 7–14.

MCALPINE, D. K. 1991. Marginidae, a new Afrotropical family of Diptera (Schizophora: ? Opomyzoidea). *Annals of the Natal Museum* **32**: 167–177.

——— 1993. Review of the upside-down flies (Diptera: Neurochaetidae) of Madagascar and Africa, and evolution of neurochaetid host plant associations. *Records of the Australian Museum* **45** (2): 221–239.

MCALPINE, J. F. 1989. Phylogeny and classification of the Muscomorpha. *In*: McAlpine, J. F. ed. *Manual of Nearctic Diptera*. Vol. 3. Ottawa: Agriculture Canada, Research Branch. (Monograph; No. 32) pp. 1397–1518.

MACARTHUR, R. H. & WILSON, E. O. 1967. *The theory of island biogeography*. Princeton: Princeton University Press.

McLellan, I. D. 1988. A revision of New Zealand Thaumaleidae (Diptera: Nematocera) with descriptions of new species and a new genus. *New Zealand Journal of Zoology* **15** (4): 563–575.

McNeely, J. A., Miller, K. R., Reid, W. V., Mittermeier, R. A. & Werner, T. B. 1990. *Conserving the world's biological diversity*. Gland, Switzerland: IUCN *et al.*

Meadows, M. E. & Linder, H. P. 1993. A palaeoecological perspective on the origin of Afromontane grasslands. *Journal of Biogeography* **20**: 345–355.

Palgrave, K. C. 1977. *Trees of southern Africa*. Cape Town: C. Struik.

Peterson, B. V. & Theischinger, G. 1989. Family Thaumaleidae. *In*: Evenhuis, N. L. ed. *Catalog of the Diptera of the Australasian and Oceanic Regions*. Honolulu: Bishop Museum Press pp. 219–220.

Rabinowitz, D., Cairns, S., & Dillon, T. 1986. Seven forms of rarity and their frequency in the flora of the British Isles. *In*: Soule, M. E. & Wilcox, B. A. eds. *Conservation biology – the science of scarcity and diversity*. Sunderland, Massachusetts: Sinauer Associates pp. 182–205.

Roberts, H. 1969. Forest insects of Nigeria with notes on their biology and distribution. *Commonwealth Forestry Institute Paper* **44**: 1–206.

Schneider, S. N. 1989. The greenhouse effect: science and policy. *Science* **243**: 771–781.

Soulé, M. E. & Wilcox, B. A. eds. 1980. *Conservation Biology: an evolutionary-ecological approach*. Sunderland, Massachusetts: Sinauer Associates.

Stuckenberg, B. R. 1960. A new genus and species of Thaumaleidae from South Africa (Diptera). *Proceedings of the Royal Society of London Ser. B* **29**: 107–109.

——— 1961. Diptera (Nematocera): Thaumaleidae. *In*: Hanström, B. *et al.* eds. *South African Animal Life*. Vol. 8. Göteberg: Almqvist and Wiksell pp. 409–412.

——— 1962. The distribution of the montane palaeogenic element in the South African invertebrate fauna. *Annals of the Cape Provincial Museums* **2**: 190–205.

——— 1980. Family Thaumaleidae. *In*: Crosskey, R. W. ed. *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History) p. 149.

Theischinger, G. 1986. Australian Thaumaleidae (Insecta: Diptera). *Records of the Australian Museum* **38**: 291–317.

Unesco, AETFAT & UNSO. 1981. *Vegetation map of Africa*. Paris: Unesco.

Vaillant, F. 1960. A new thaumaleid (Diptera) from Madeira. *Boletim do Museu Municipal do Funchal* **17** (60): 25–28.

White, F. 1978. The Afromontane Region. *In*: Werger, M. J. A. ed. *Biogeography and ecology of southern Africa*. The Hague: Junk pp. 463–513.

——— 1983. *The vegetation of Africa: a descriptive memoir to accompany the Unesco/AETFAT/UNSO vegetation map of Africa*. Paris: Unesco.

Wood, D. M. & Borkent, A. 1989. Phylogeny and classification of the Nematocera. *In*: McAlpine, J. F. ed. *Manual of Nearctic Diptera*. Vol. 3. Ottawa: Agriculture Canada, Research Branch. (Monograph; No. 32) pp. 1333–1366.

Wood, H. G. 1952. The crane-flies of the south-west Cape (Diptera, Tipuloidea). *Annals of the South African Museum* **39**: 1–327.

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ADDENDUM

Shortly before the printing of this paper, further data on Thaumaleidae became available. One of us (DAB) recently attended the Third International Congress of Dipterology at Guelph, Canada and presented a poster based on the data in this paper. Resulting from this, an additional unidentified female was sourced from the Canadian National Collections in Ottawa by Dr A. Downes and Dr B. Sinclair. Locality data are: 'RSA: Cape Prov. / Knysna, Diepwalle / 12–30.xii.1981, S & J Peck / forest malaise-trough'. Diepwalle is a montane area of indigenous forest about 13 km NE of Knysna, being just to the east of Prince Alfred's Pass.